

<p align="center">40 DETERMINATION OF TOTAL ACIDS IN ALCOHOLIC BEVERAGES</p>	<p align="center">Page 1 of 2</p>
<p align="center">Division of Forensic Science</p> <p align="center">TOXICOLOGY TECHNICAL PROCEDURES MANUAL</p>	<p>Amendment Designator:</p>
	<p>Effective Date: 31-March-2004</p>
<p align="center">40 DETERMINATION OF TOTAL ACIDS IN ALCOHOLIC BEVERAGES</p> <p>40.1 Summary</p> <p>40.1.1 Determination of total acids provides a key to the identification of alcoholic beverages as well as a measurement of the distiller's or vintner's quality control of known products. The results of the total acid analysis are compiled with each known brand's historical data for comparison and evaluation. Unknown brands' total acids are compared to the known brand values in order to identify class of beverage or particular brand. The determination of total acidity is accomplished by titrating an aliquot of the alcoholic beverage with 0.1 N sodium hydroxide. The color indicator, phenolphthalein, changes color as the mixture reaches the neutral point. The volume of sodium hydroxide needed to neutralize the acids present in the beverage is read from the titrating buret and is used to calculate total acids present.</p> <p>40.2 Reagents</p> <p>40.2.1 0.1 N sodium hydroxide (e.g. Fisher)</p> <p>40.2.2 1% phenolphthalein (e.g. Fisher)</p> <p>40.2.3 Control whiskey or wine</p> <p>40.3 Apparatus</p> <p>40.3.1 Pipets, Class A: 1 mL, 5 mL and 25 mL</p> <p>40.3.2 Titration buret, 50 mL, automatic refilling type</p> <p>40.3.3 250 mL Erlenmeyer flasks</p> <p>40.4 Procedure</p> <p>40.4.1 For wines, liqueurs and mixed drinks:</p> <p>40.4.1.1 Pipet 5 mL each of control and samples into appropriately labeled 250 mL Erlenmeyer flasks.</p> <p>40.4.1.2 Add 3 drops 1% phenolphthalein to each flask.</p> <p>40.4.1.3 Add 25 mL dH₂O to each flask. Note: for samples that are deeply colored (e.g. Grenadine), use only 1 mL sample add 50-100 mL dH₂O.</p> <p>40.4.1.4 Fill buret with 0.1N NaOH.</p> <p>40.4.1.5 Place each flask under buret and titrate with 0.1 N NaOH until pink color develops and persists for approximately 30 seconds. Read and record volume of NaOH added to the nearest 0.1 mL.</p> <p>40.4.1.6 For red wines, a gray color will develop as red tannins are neutralized. Continue adding 0.1 N NaOH until a purple hue develops (true end point). Read and record volume of NaOH added to the nearest 0.1 mL.</p> <p>40.4.2 For distilled spirits:</p>	

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- 40.4.2.1 Pipet 25 mL each of control and samples into appropriately labeled 250 mL Erlenmeyer flasks.
- 40.4.2.2 Add 3 drops 1% phenolphthalein to each flask.
- 40.4.2.3 Add 25 mL dH₂O to each flask.
- 40.4.2.4 Fill buret with 0.1N NaOH.
- 40.4.2.5 Place each flask under buret and titrate with 0.1 N NaOH until pink color develops and persists for approximately 30 seconds. Read and record volume of NaOH added to the nearest 0.1 mL.
- 40.4.2.6 For straight whiskies, the straw color of diluted sample turns burnt orange followed by a red amber color. Continue adding 0.1 N NaOH until the red amber color develops (true end point). Read and record volume of NaOH added to the nearest 0.1 mL.

40.5 Calculation

- 40.5.1 For wines, liqueurs and mixed drinks, use the following equation to calculate total acids:

$$\frac{(\text{mL } 0.1 \text{ N NaOH added}) \times (\text{equivalent of } 1 \text{ mL NaOH}) \times 100}{\text{volume (mL) of sample aliquot}} = \text{predominant acid in grams/100 mL}$$

Example: A 5 mL aliquot of Burgundy wine required 3.5 mL of 0.1 N NaOH to be neutralized. The total acid is expressed in grams tartaric acid (predominant acid in grape wines) per 100 mL.

$$\frac{(3.5 \text{ mL NaOH added}) \times (0.0075 \text{ g tartaric acid/1 mL NaOH}) \times 100}{5 \text{ mL burgundy wine}} = 0.525 \text{ g tartaric acid/100 mL}$$

- 40.5.2 For distilled spirits such as whiskey, use the following equation to calculate total acids:

$$\frac{(\text{mL } 0.1 \text{ N NaOH added}) \times (\text{equivalent of } 1 \text{ mL NaOH}) \times 100,000}{\text{volume (mL) of sample aliquot}} = \text{acetic acid in grams/100 L}$$

Example: A 25 mL aliquot of bourbon whiskey required 2.2 mL of 0.1 N NaOH to be neutralized. The total acid is expressed in grams acetic acid (predominant acid in distilled spirits) per 100 L.

$$\frac{(2.2 \text{ mL NaOH added}) \times (0.0060 \text{ g acetic acid/1 mL NaOH}) \times 100,000}{25 \text{ mL bourbon whiskey}} = 52.8 \text{ g acetic acid/100 L}$$

40.6 Interpretation

- 40.6.1 In general, the value of a known product's acidity should be within the historical range of the particular product. If a new product, the product's total acid content should be compared to other known similar products.

40.7 References

- 40.7.1 AOAC 15th edition, 962.12, 1990.
- 40.7.2 Laboratory Procedures for Enologists. Maynard Amerine, 1967, p 56.
- 40.7.3 Handbook of Chemistry. Alfred Lange, 10th edition, 1967, p 1015.